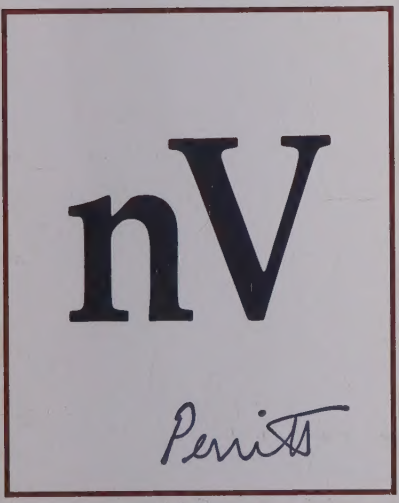
KEITHLEY

QUICK REFERENCE GUIDE



MODEL 181 NANOVOLTMETER

BARCODE 06065

INTRODUCTION

The Keithley 181 Nanovoltmeter is easily interfaced to common controllers using the IEEE-488 bus. The following programs select the 2V range and obtain a reading on the following controllers:

APPLE II, DEC LSI 11, HP 85, HP 9825A, PET/CBM 2001, TEK 4052, HP 9816, IBM PC.

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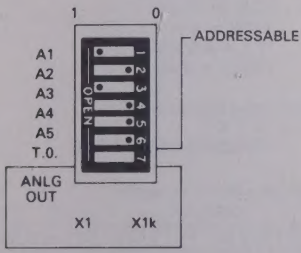

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PROGRAM CODES

RANGES:	R1 = 0.002V
	R2 = 0.02V
	R3 = 0.2V
	R4 = 2V
	R5 = 20V
	R6 = 200V
	R7 = 1000V
ZERO:	Z0 = Off
	Z1 = On
TRIGGER:	T0 = Cont. on TALK
	T1 = One Shot on TALK
	T2 = Cont. on GET
	T3 = One Shot on GET
RESOLUTION:	B0 = 5½ Digit Display
	B1 = 6½ Digit Display
FILTERING:	P0 = Filter Disabled
	P1 = Filter 1
	P2 = Filter 2
	(Front Panel Filter ON)
DAMPING:	D0 = Off
	D1 = On
MODE:	M0 = SRQ OFF
	M1 = SRQ ON
EOI:	K0 = Send
	K1 = Do Not Send
TERMINATOR:	Y(LF) = CR LF
	Y(CR) = LF CR
	Y( ) = Any ASCII
	Y(DEL) = None

X = Execute

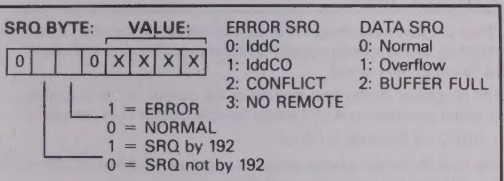
UX = Send status bytes. Sequence is:
R B Z P D M T K Y

DEFAULT: R7B0Z0P1D0M0T0K0Y(LF)

DATA FORMAT: 16 bytes + terminator

	FUNCT.			DISPLAY								EXP.			TERMINATOR	
N	D	C	V	+	1	2	3	.	4	5	6	7	E	+	0	CR	LF

N = Normal
Z = Zeroed
O = OFLO


SRQ BYTE:
VALUE:
0
0
X
X
X
X
1 = ERROR
0 = NORMAL
1 = SRQ by 192
0 = SRQ not by 192
ERROR SRQ
0: IddC
1: IddCO
2: CONFLICT
3: NO REMOTE
DATA SRQ
0: Normal
1: Overflow
2: BUFFER FULL

PROGRAMS

These programs are designed to be a simple aid to the user, and are not intended to suit specific needs. Detailed programming information can be found in the manual.

The programs display one reading at the output of the controller. The program provides an ASCII string variable output (A$), of the form:

NDCV+0.000000E 0 CR LF

The note at the end of each program indicates modification to provide a numeric variable (A) in expotential form:

+0.000000E+0

APPLE II (APPLE Interface)

The program below obtains one reading from the Model 181 NVM and displays the reading on the APPLE II screen, using an APPLE IEEE-488 interface.

DIRECTIONS

1. Set switches on 181 to addressable mode, primary address 5.
2. Connect 181 to APPLE II and APPLE IEEE-488 interface.
3. Enter program below using the RETURN key after each line.
4. Type in RUN and depress the RETURN key.
5. The display will read "TEST SETUP".
6. To program the 181 to the 2V range and take a reading, type in R4X and depress the RETURN key.
7. Display will read NDCV+0.000000E+0 for "0" volts in.

PROGRAM	COMMENTS
10 DIM A$(20),B$(20)	To dimension data string.
20 Z$=CHR$(26)	
30 INPUT "TEST SETUP?" ;B$	Enter programming command. (Example: 2V range = R4X.)
40 PR#3	Send output to IEEE bus.
50 IN#3	Set input from IEEE bus.
60 PRINT "RA"	Turn remote ON.
70 PRINT "WT%";Z$;B$	Output programming command to 181.
80 PRINT "LF1"	Linefeed on.
90 PRINT "RDE";Z$;: INPUT" ";A$	Read data from 181.
100 PRINT "UT"	Untalk.
110 PR#0	Send output to CRT.
120 IN#0	Get input from keyboard.

```
130 PRINT A$                    Display data string.
140 GO TO 30                    Repeat.
```
NOTE: If conversion to numeric variable is desired, add the following:
```
134 A=VAL(MID$(A$,5,16))        Convert string to numeric value.
136 PRINT A
```

DEC LSI 11

The program below obtains one reading from the Model 181 NVM and displays the reading on the DEC LSI 11 microcomputer CRT terminal. The LSI 11 must be configured with 16K words of RAM and an IBV 11 IEEE interface. The software must be configured with IB software as well as the FORTRAN and the RT 11 operating system.

DIRECTIONS

1. Set switches on 181 to addressable mode, primary address 5.
2. Connect 181 to the IBV 11 IEEE cable.
3. Enter the program below, using the editor under RT 11 and the name IPHILD.
4. Compile using the FORTRAN compiler as follows: FORTRAN IPHILD
5. Link with the system and IB libraries as follows: LINK IPHILD,IBLIB
6. Type RUN IPHILD and depress the RETURN key.
7. The display will read "ENTER ADDRESS". Type in 5 and press RETURN.
8. To program the 181 to the 2V range and take a reading, type in R4X and depress the RETURN key.
9. Display will read NDCV+0.000000E 0 for "0" volts in.

```
PROGRAM IPHILD                      COMMENTS
INTEGER*2 PRIADR
LOGICAL*1 MSG(80),INPUT(80)
    DO 2 I=1,10
    CALL IBSTER (I,0)               !Turn off IB errors.
 2  CONTINUE
    CALL IBSTER (15,5)              !Allow 5 error 15's.
    CALL IBTIMO (120)               !Allow 1 sec. bus timeout.
    CALL IBTERM ("10)               !Set LF as terminator.
    CALL IBREN                      !Turn remote on.
 4  TYPE 5
 5  FORMAT (1X,'ENTER ADDRESS',$)   !Input the address 5.
    ACCEPT 10,PRIADR
10  FORMAT (214)
12  TYPE 15
```

```
15 FORMAT (1X,'TEST SETUP',$)        !Prompt for test setup.
   CALL GETSTR (5,MSG,72)            !Get the test setup.
   CALL IBSEOI (MSG,-1,PRIADR)       !Program the 181.
18 I=IBRECV (INPUT,80,PRIADR)        !Get data from the 181.
   INPUT (I+1)=0
   CALL PUTSTR (7,INPUT,'0')
   CALL IBUNT                        !Untalk the 181.
   GO TO 12                          !Repeat.
   END
```

HP 85

The program below obtains one reading from the Model 181 NVM and displays the reading on the HP 85 CRT screen, using the 82937A GPIB interface and an I/O ROM.

DIRECTIONS

1. Set switches on 181 to the addressable mode, primary address ⌜
2. Connect 181 to the HP 82937A IEEE interface.
3. Depress SHIFT SCRATCH and then depress END LINE to erase previous program.
4. Enter the program below using the END LINE key after each line.
5. Depress the RUN key.
6. The display will read "TEST SETUP".
7. To program the 181 to the 2V range and take a reading, type in R4X and depress the END LINE key.
8. Display will read NDCV +0.000000E 0 for "0" volts in.

PROGRAM	COMMENTS
10 REMOTE 705	Turn remote on.
20 DISP "TEST SETUP"	Prompt for test setup.
30 INPUT A$	
40 OUTPUT 705; A$	Program the 181.
50 ENTER 705; B$	Get data from the 181.
60 DISP B$	
70 GO TO 20	Repeat.
80 END	

NOTE: If conversion to numeric variable is needed change lines 50 and 60 as follows:

```
50 ENTER 705; B
60 DISP B
```

HP 9825A

The program below obtains one reading from the Model 181 NVM and displays the reading on the HP 9825A using a 98034A HPIB interface and a 9872A extended I/O ROM.

DIRECTIONS

1. Set switches on 181 to the addressable mode, primary address 5.
2. Connect 181 to HP 9825A and 98034A HPIB interface.
3. Enter the program below, using the STORE key after each line.
4. Depress the RUN key.
5. The display will read "TEST SETUP".
6. To program the 181 to the 2V range and take a reading, type in R4X and depress the CONT key. (Note: R = range; 4 = 2V range.)
7. Printer will read NDCV + 0.000000E 0 for "0" volts in.

PROGRAM	COMMENTS
0 dim A$[20], B$[20]	To dimension data string.
1 dev "181", 705	Define Model 181 NVM primary address.
2 rem "181"	Enter programming command (Example: 2V range = R4X.)
3 ent"TEST SETUP", A$	
4 wrt"181", A$	Output program command to Model 181 via IEEE bus.
5 red"181", B$	Read data from Model 181 via IEEE bus.
6 prt B$	Print data on hard copy printer.
7 gto 3	Repeat.

NOTE: If conversion to numeric variable is desired, omit lines 6 and 7 and substitute:

6 "e"→B$[14, 14]; flt5	Convert to numeric value.
7 prt val(B$[5])	
8 gto 3	Repeat.

PET/CBM 2001

The program below obtains one reading from te Model 181 NVM and displays the reading on the PET/CBM 2001.

DIRECTIONS

1. Set switches on 181 to the addressable mode, primary address 5.
2. Connect 181 to PET/CBM 2001 IEEE interface.
3. Enter the program below using the RETURN key after each line.
4. Type RUN and depress the RETURN key.
5. The display will read "TEST SETUP".

6. To program the 181 to the 2V range and take a reading, type in R4X and depress the RETURN key.
7. Display will read NDCV+0.000000E 0 for "0" volts in.

PROGRAM	COMMENTS
10 OPEN 6,5	Open file 6, primary address 5.
20 INPUT "TEST SETUP"; B$	Enter programming command. (Example: 2V range = R4X.)
30 PRINT #6,B$	Output to the IEEE bus.
40 INPUT #6,A$	Read data from Model 181 via IEEE bus.
50 IF ST=2 THEN 40	If time out, input again.
60 PRINT A$	Print data.
70 GO TO 20	Repeat.

NOTE: If conversion to numeric variable is desired, omit line 60 and type the following:

70 A=VAL(MID$(A$,5,16))	Convert string to numeric variable.
80 PRINT "A="; A	
90 GO TO 20	Repeat.

TEK 4052

The program below obtains one reading from the Model 181 NVM and displays the reading on the TEK 4052 graphics terminal, with a 4051 GPIB interface.

DIRECTIONS

1. Set switches on 181 to the addressable mode, primary address 5.
2. Connect 181 to TEK 4051 IEEE interface.
3. Enter the program below using the RETURN key after each line.
4. Type in RUN.
5. The display will read "TEST SETUP".
6. To program the 181 to the 2V range and take a reading, type in R4X and depress the RETURN key.
7. Display will read NDCV+0.000000E 0 for "0" volts in.

PROGRAM	COMMENTS
5 PRINT @ 37, 10: 255, 13	
10 PRINT "TEST SETUP"	Prompt for the test setup.
20 INPUT A$	
30 PRINT @ 5:A$	Program the 181.
40 INPUT %5:A$	Get the data from the 181.
50 PRINT B$	
60 GO TO 10	Repeat.

NOTE: If conversion to numeric value is needed, change 40 and 50 to:
40 INPUT %5:A
50 PRINT A

HP 9816

The following program sends a command string to the Model 181, reads data, and displays it on the HP 9816 display, using BASIC 2.0.

DIRECTIONS

1. Set the Model 181 to the addressable mode, primary address with the rear panel switches.
2. With the power off, connect the Model 181 to the HP 9816.
3. Enter the program below using the ENTER key after each line is typed.
4. Press the HP 9816 RUN key.
5. The display will read "TEST SETUP"
6. To program the Model 181 to the 2VDC range, type in R4X and press the ENTER key.
7. The display will read NDCV+0.000000E+0 for "0" volts in.

PROGRAM	COMMENTS
10 REMOTE 705	Set to remote.
20 INPUT "TEST SETUP", A$	Prompt for test setup.
30 OUTPUT 705; A$	Send command string to 181.
40 ENTER 705; B$	Get data string from 181.
50 PRINT B$	Display data string.
60 GO TO 20	Repeat.
70 END	

NOTE: If conversion to numeric variable is needed, change lines 40 and 50 as follows:
40 ENTER 705; B
50 PRINT B

HP 9826

The following program sends a command string to the Model 181, reads data, and displays it on the HP 9826 display, using BASIC ROMs.

DIRECTIONS

1. Set the Model 181 to the addressable mode, primary address.
2. With power off, connect the Model 181 to the HP 9826.

3. Enter the program below using the EXECUTE key after each line is typed.
4. Press the HP 9826 RUN key.
5. The display will read "TEST SETUP"
6. To program the Model 181 to the 2VDC range, type in R4X and press the END LINE key.
7. The display will read NDCV+0.000000E+0 for "0" volts in.

PROGRAM	COMMENTS
10 REMOTE 716	Set to remote.
20 PRINT "TEST SETUP"	Prompt for test setup.
30 INPUT A$	
40 OUTPUT 716; A$	Send command string to 181.
50 ENTER 716; B$	Get data string from 181.
60 PRINT B$	Display data string.
70 GO TO 20	Repeat.
80 END	

NOTE: If conversion to numeric variable is needed, change lines 50 and 60 as follows:

```
50 ENTER 716; B
60 PRINT B
```

IBM PERSONAL COMPUTER XT or PC

The following program sends a command to the Model 181 and displays the reading on the IBM personal computer display. The equipment required for this program is the IBM personal computer XT or PC, the National Instruments GPIB-PC interface and the DOS 2.00 operating system. The GPIB software and hardware must be installed and configured per the National Instruments GPIB-PC instruction manual.

DIRECTIONS

1. Set the Model 181 to the addressable mode, primary address 5 with rear panel switches.
2. Connect the Model 181 to the GPIB-PC interface with power off.
3. Type the command BASIC on the IBM keyboard to get into the IBM interpretive BASIC language.
4. Type in the command LOAD "DECL" to prepare the system for programming. The LOAD "DECL" command takes up the first five lines of the program. Refer to the program.
5. Type in the following program starting with line 10.
6. Type in RUN to execute the program.
7. The display will read "ENTER COMMAND".
8. To program the Model 181 to the 2V range and read data, type in R4X

and press the return key.

9. The display will read NDCV+0.000000E+0 for "0" volts in.

PROGRAM	COMMENTS
1 CLEAR, 60000!	The first five lines do not
2 IBINIT = 60000!	have to be typed in. Typing
3 BLOAD "bib.m",IBINIT	in LOAD"DECL" ac-
4 IBSTA%=0:IBCNT%=0:IBERR%=0	complishes this task.
5 CALL IBINIT (IBRD%,IBWRT%, IBCMD%,IBWAIT%,IBRPP%, IBONL%,IBSRC%,IBSIC%, IBSRE%,IBRTL%,IBSRV%, IBLPE%,IBPAD%,IBSAD%, IBIST%,IBDMA%,IBEOS%, IBTMO%,IBEOT%,IBGTS%, IBCAC%,IBDIAG%,IBSTA%, IBERR%,IBCNT%)	
10 BD%=0	Interface board number is 0.
20 RD$=SPACE$(20)	Data buffer=20 bytes.
30 V%=0: CALL IBPAD%(BD%, V%)	Primary address of GPIB is 0.
40 CALL IBSIC%(BD%)	Interface clear.
50 V%=1:CALL IBSRE%(BD%,V%)	Set 181 to remote.
60 CMD$="@%"	Listen address of 181.
70 INPUT "ENTER COMMAND";C$	Prompt for command.
80 CALL IBCMD%(BD%,CMD$)	Address 181 to listen.
90 CALL IBWRT%(BD%,C$)	Send 181 command string.
100 CMD$=" E"	Talk address of 181.
110 CALL IBCMD%(BD%,CMD$)	Address 181 to talk.
120 CALL IBRD%(BD%,RD$)	Get data string from 181.
130 PRINT RD$	Print data string.
140 GO TO 60	Repeat

NOTE: If conversion to numeric variable is needed, change line 130 to:

```
130 PRINT VAL(MID$(RD$,5,16))
```

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SOURCE • MEASURE • CONNECT

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